Solitaire: Man Versus Machine

Xiang Yan[1]

Persi Diaconis[2]

Paat Rusmevichientong[3]

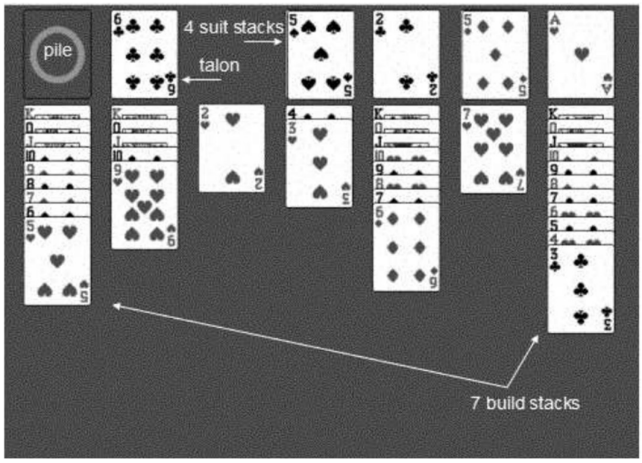
Benjamin Van Roy[4]

[1] Stanford University,
xyan,persi.diaconis,bvr@stanford.edu

[2] Cornell University,
paatrus@orie.cornell.edu

Abstract

In this paper, we have tried to improve the original version of klondike solitaire so that chances of winning the game gets improved. This version of solitaire, uses a rollout strategy to improve the performance, is also known as thoughtful solitaire.



Action generated by the rollout method can be considered and alternative heuristic which improves on the original. In this version of the game all cards are revealed to the players in the starting but after that is follows the normal game rules. The goal of the game is to move all cards into suit stacks.

We have developed two different strategies to play thoughtful solitaire-heuristic strategy and rollouts. However, both are based on same general procedure. It first identifies the legal moves executes it and then repeat the procedure keeping in mind that new card configuration doesn't repeat the previous one. The only nontrivial task in this procedure is selection from the legal moves.

Thoughtful Solitaire was introduced by a senior American mathematician. This version of solitaire is much more thought-provoking and challenging than original klondike.

However, our heuristic strategy follows the method to assign a priority in the moves, so that the move which maximizes the score based on scoring system is performed. Apart from this, we also modified the scoring system further by adding some new rules which can lead to a score of zero or a negative. We finally implemented this heuristic strategy. Rollout is used to amplify the performance of any strategy by doing sufficient number of iterations. However, the computation time required grows exponentially in number of iterations therefore this method sometimes doesn't seem practical.

A large number of games were played with the algorithm in order to approximate success probability. Central Limit Theorem was used to compute the confidence bound on success probability. A confidence bound of around -1.4 to 1.4 percent was achieved in 3 rollout iterations. Interestingly, after 5 rollout iteration the resulting strategy wins almost twice as frequently as our esteemed mathematician.

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